Rack with an Electrification Arrangement

The invention relates to a frame support for a rack or a switchgear cabinet, having an electrification arrangement, which is combined with at least one frame leg or profiled mounting element, for supplying and/or removing electrical current to or from devices which can be connected with it.

Such a frame support is recited in DE 37 06 797 A1. In this known frame support, hollow vertical supports and hollow horizontal supports, which are connected by means of extension channels with the latter and have an identical profile cross section as the vertical supports, are provided, wherein the hollow spaces of the vertical supports and horizontal supports are intended to make available as much cable guidance space as possible for conducting electrical cables placed in them. On the other hand, with frame supports for switchgear cabinets, racks or workplace systems with table structures used in connection with information technology in particular, efforts are made to keep the frame legs of the smallest possible size, but with the greatest amount of stability possible and, in connection with a switchgear cabinet, for example, to utilize the interior for installing devices in an as unlimited as possible way.

As DE 40 13 370 A1 shows, in the field of electrical installation technology cable conduits exist, which are provided with a cover, in which contact rails are conducted, which have been embedded in the linear direction in an insulating material. Installed devices, which can be brought into contact with the installation rails, are snapped onto the arrangement.

Various frame supports for switchgear cabinets, i.e. inter alia also cabinets for information technology apparatus, are shown in DE 33 44 598 A1, DE 44 39 551 A and DE 196 47 814 A1, wherein in view of simple varied assembly options the frame legs, as well as the line-up or sealing, are optimized.

The object of the invention is based on making available a frame support of the type mentioned at the outset which, along

with the least possible outlay, offers improved installation options for devices to be supplied with electricity, and to disclose an electrification arrangement which is easy to integrate into a frame support.

This object is attained by means of the characteristics of claim 1. In accordance with this it is provided that the electrification arrangement has at least one separate electrification strip attached to a frame leg or profiled mounting element which is formed by a hollow profiled receiving element, which is at least partially open on a long side and in whose at least one hollow space contact rails or connection lines are installed in a manner protected against electric shock, and that inserts are provided, which are inserted or can be inserted into the electrification strip and have plug receivers protected against electric shock for device plugs of the devices to be connected, as well as contact elements, which are or can be brought into electrical contact with the contact rails or connecting lines.

With such a design of the electrification arrangement, easily accessible, defined connecting options for the electrical devices received in or on the frame support exist without elaborate cable conduits, wherein the electrification strip can also easily be retrofitted and prefitted with inserts suitable for the requirements of the user. For example, the electrification strip can also be attached to the inside of a door arranged on the frame. The exchange of the electrification strip with one of different fittings is possible in a simple and cost-effective manner. Because a central component of the electrification arrangement has been predetermined and adheres to the protection requirements, an inappropriate electrical installation and overloading of current-conducting elements is prevented.

An advantageous embodiment consists in that a profiled insulating element, in which the contact rails are embedded and are accessible in a manner protected against electric shock

through access openings formed in the profiled insulating element, has been inserted into at least one hollow space of the profiled receiving element.

Simple operation and measures for protecting users are aided in that the hollow space is shaped rectangular or square in cross section and has a base wall located opposite the open longitudinal side, which is adjoined by lateral walls, that the bottom of a bottom section of the profiled insulated element in which the contact rails are embedded faces the base wall or a lateral wall, and that the contact rails can be brought into contact with the contact elements via access openings, which are kept narrow for electric shock protection and have been cut into the bottom section of the side located opposite the bottom side.

Steps also contribute to a construction which is advantageous for manufacture, wherein the insulated profiled element is fixed in place in the profiled receiving element by means of snap-in structures arranged on it and complementary counter-snap-in structures arranged in the profiled receiving element.

Steps for preventing inappropriate use are advantageous, wherein the snap-in structures and the counter-snap-in structures have steep snap-in flanks opposite the insertion direction, so that the profiled insulating element cannot be removed without being destroyed.

Assembly and a secure structure are furthermore aided in that the profiled insulating element has been assembled from a profiled base insulating part, which receives the contact rails in longitudinal chambers and insulates them from each other, and a profiled top insulating part, which covers the contact rails and has access openings.

Dependable electric shock protection and a definite arrangement of the inserts are aided in that the access openings of each insert are formed by a group of at least two hole-shaped access openings, which are assigned to separate contact rails.

A definite arrangement of the inserts is furthermore aided in that at least two access openings are offset from each other in the longitudinal direction of the profiled insulating element.

Steps are moreover advantageous for contacting and the shape of the inserts, wherein the contact elements are designed as contact pins, which have been matched in size and position to the access openings.

Those steps contribute to simple assembly, wherein the inserts are provided with snap-in elements, by means of which they can be fixed in place so they cannot be removed from the profiled receiving element or the counter-snap-in elements formed on the profiled insulating element without being destroyed, or can only be removed by using a tool.

If it has been provided that at least three contact rails are embedded in the profiled insulating element, by means of which at least two separate current supply circuits are formed, it is simple to change, for example, from a standard current supply by means of the power lines to an interruption-proof power supply, when the standard current supply fails. Alternatively, the separate supply circuits can also be used for avoiding an overload in that the number of the inserts used is distributed over the different current supply circuits. For example, a contact rail located in the center can be embodied as the ground rail and can also be designed to be stronger in comparison with the contact rails located laterally next to it, or can be arranged at a higher or lower level. For example, with the contact rails assigned to the three phases, it is possible to form three standard current supply circuits with the central ground rail.

An embodiment advantageous for the use of standardized built-in devices consists in that the dimension of the inserts in the longitudinal direction of the electrification strip is a unit of height or a whole-number multiple thereof, and that the inserts are designed for receiving one or several appliance plugs.

A simple and unequivocal assembly wherein, for example, the

pattern of the frame legs in relation to a pattern or marking of the electrification strip can be used, consists in that the profiled receiving element is provided on at least one longitudinal side with fastening elements for connection with at least one frame leg or profiled mounting element. In this case various advantageous embodiment possibilities arise in that the fastening elements are embodied for a screw, clip, snap-in, plug or clamping connection.

An advantageous manipulation in the course of the arrangement in a frame support results in that the profiled receiving element is embodied to be H-shaped in cross section with two lateral walls and a center wall, and that the inserts are placed into the hollow space on a side of the center wall facing the user, while the contact rails or the connecting lines are placed into the hollow space facing away from the user and are accessible through the center wall.

The steps, that cutouts are provided in the center wall, into which plug-in couplings have been inserted in a manner protected against electric shock, which are accessible from the user side, and that at least one plug unit matched to the plug-in couplings is arranged on the back of the inserts facing away from the user, contributes to a simple mounting with a definite arrangement.

The simple use of different current supply arrangements is achieved in that two plug-in couplings per insert, which are spaced apart from each other in the longitudinal direction of the profiled receiving element, are provided and are connected to different current supply arrangements, and that the backs of the inserts for selecting one of the two current supply arrangements can be inserted into the profiled receiving element rotated by 180° and can be connected with the respective plug-in coupling. In a simple way the user can provide, for example, a standard current supply or an interruption-proof current supply.

Moreover, an advantageous structure with a simple operation

consists in that the inserts are modular housings with cap-like closure pieces which, from one of the adjoining narrow sides, have been placed on their ends which are remote from each other in the longitudinal direction, and on the sides of which the snap-in elements are formed of one piece with resilient snap-in fingers and actuating elements for release.

The application is furthermore favored in that an overload release device is integrated into the inserts.

Furthermore, the steps are advantageous for connecting the electrification arrangement, wherein at least one electric shock protected current feed-in coupling for the current supply is arranged in an end section of the profiled receiving element, and wherein a current feed-in plug matched to the current feed-in coupling and having a current supply cable connected therewith is provided.

Further advantageous embodiments regarding the functioning and application consist in that the current feed-in coupling is embodied on or in a feed-in module, and that a line element for voltage conversion or adaptation, a current limiting device and/or a switching element for the sequential activation of individual inserts is integrated into the feed-in module.

An advantageous installation is offered in that the electrification arrangement for a rack or a switchgear cabinet is designed with a structure in accordance with the characterizing portion of claim 1.

Here, advantageous embodiments consist in a design in accordance with dependent claims 2 to 22.

The invention will be explained in greater detail in what follows by means of exemplary embodiments and by making reference to the drawings. Shown are in:

Fig. 1, a perspective representation of a frame support with profiled mounting elements integrated into it, and a vertical electrification strip in a perspective view,

Fig. 2, an electrification strip mounted corresponding to

Fig. 1 along a vertical profiled mounting element of a switchgear cabinet frame support behind a door edge in a perspective view,

Fig. 3, a further frame support of a switchgear cabinet with an installed door and an electrification strip mounted along a vertical profiled mounting element in a perspective plan view from the rear in contrast to Fig. 2,

Fig. 4A, a portion of an electrification strip with an inserted profiled insulating element and an insert in a perspective representation,

Fig. 4B, a cross section through a profiled receiving element of the electrification strip in Fig. 4A,

Fig. 4C, a lower portion of a profiled insulating element with inserted contact rails in a perspective plan view,

Fig. 4D, a section of a profiled insulating element combined from a profiled base insulating part and a profiled top insulating part,

Figs. 5A and 5B, a lower insert element of two sides rotated by 90° in relation to each other,

Fig. 5C, an insert combined from a lower insert element and an upper insert element in a perspective view,

Fig. 6, a further exemplary embodiment of an electrification strip,

Fig. 7A, an exploded perspective representation of a further exemplary embodiment of a profiled insulating element and inserts to be placed therein,

Fig. 7B, a portion from a further electrification strip with the profiled insulating element and the inserts in accordance with Fig. 7A in a different perspective plan view,

Fig. 7C, the electrification strip in Fig. 7B in an assembled representation in a further perspective plan view,

Figs. 8A and 8B, a portion of a further electrification strip with inserted or removed insert in a perspective plan view,

Fig. 9, a portion of the electrification strip in accordance with Figs. 8A, 8B in the area of an electrical current

feed-in arrangement, and

Fig. 10, a connecting diagram of an electrification arrangement, in particular in accordance with Figs. 8A to 9.

A frame support 1 made of vertical frame legs 2 and horizontal frame legs 3 represented in Fig. 1, which can be complemented, for example by means of wall elements and one or more door elements 8 (see Figs. 2 and 3), into a switchgear cabinet and can receive devices of information technology, for example, is equipped in its interior with vertical and horizontal profiled mounting elements 4, 5, as well as with an electrification strip 60 mounted along the vertical profiled mounting element 4. For example, the electrification strip 60 is mounted at the side of the vertical profiled mounting element 4 by means of clamps, screws, clips, snap-in or plug-in elements (not represented). As Figs. 2 and 3 show, in this arrangement the electrification strip 60 can be advantageously covered by a vertical door edge. In this case the electrification strip 60 is equipped with socket-like inserts 7 for the supply with electrical energy. Further connecting options for inserts 7 are provided in the upper portion of the electrification strip 60.

Fig. 3 shows the electrification strip 60 in Figs. 1 and 2 from its rear. Alternatively, the electrification strip 60 can also be vertically or horizontally attached to a vertical or horizontal frame leg 2, 3, or one or several profiled mounting elements, for example in the form of mounting strips 5. The electrification strip 60 can also be easily applied to the inside of the door element 8, for example to a tubular door frame provided there.

Fastening elements, for example longitudinally extending T-grooves for the insertion of a groove rail or of groove nuts, patterns of fastening holes, snap-in means, clips or plug-in means, which for example are embodied in one or several outer sides of the electrification strip 60, are provided for the attachment of the electrification strip 60. Advantageously, a U-

shaped receptacle extending along at least one frame leg is formed as one piece with the receptacle, into which the electrification strip 60 is snapped with the aid of snap-in means. In this case, the snap-in means can be longitudinal ribs or grooves extending on the outside of the electrification strip 60, and matched counter-snap-in means extending in the interior of the receptacle.

As shown in Fig. 4A, the electrification strip 60 is composed of an outer profiled receiving element 6, substantially U-shaped or, as shown in Fig. 6, substantially C-shaped in cross section, as well as of a profiled insulating element 9 with contact rails 10 embedded therein. With its base 9.3, the profiled insulating element 9 faces the base wall 6.2 of the profiled receiving element 6 and is composed, as represented in Fig. 4D, of a profiled base insulating part 9.1, with a profiled top insulating part 9.2 clipped or snapped onto it. As shown in Fig. 4C, longitudinally extending chambers are formed in the profiled base insulating part 9.1 by means of vertical, longitudinally extending insulating strips, into which the contact rails 10 have been inserted. For making contact, contact springs 10.1, U-shaped in cross section and with contact slits extending in the direction of the contact rails 10, are fastened on the side of the contact rails 10 facing away from the base 9.3 by means of laser welding, for example, and can be stabilized by means of support projections 10.11 resting on the strips. On the outside of their free edges, the outer strips of the profiled base insulating part 9.1 have bead-like snap-in edges 9.11 which, in the assembled state, are covered by the inside of matched facing outer strips of the profiled top insulating part 9.2 and are kept together by means of the elastic forces of the strips.

In the area of the lower edges of the lateral strips of the profiled top insulating part 9.2 facing the profiled base insulating part 9.1, respective strip-shaped snap-in springs 9.21 have been formed, which are conducted at a distance from the lateral strips approximately as far as the level of the top of the

profiled top insulating part 9.2, and which are provided with snap-in hooks 9.22 on the exteriors of their free ends. The profiled receiving element 6 has snap-in grooves 6.11 as counter snap-in structures, which act together with the snap-in hooks 9.22 and which are engaged by the snap-in hooks 9.22 when the profiled insulating element 9 has been completely inserted. The snap-in hooks 9.22 and the snap-in grooves 6.11 are provided with steep snap-in flanks in the direction opposite their insertion direction, so that the profiled insulating element 9 inserted into the profiled receiving element 6 cannot be removed without it being destroyed. For insertion, the snap-in hooks 9.22 are provided on their underside with inclined snap-in flanks in the insertion direction.

On its top, the profiled top insulating part 9.2 has rectangular contact openings 9.23, which are spaced apart from each other in the transverse direction corresponding to the spacing of the contact rails 10 and are oriented in the direction of the contact rails 10, and which are engaged by correspondingly flat contact pins 7.11, rectangular in cross section, which are intended to come into contact with the contact rails 10. The contact openings 9.23 are arranged spaced apart in the longitudinal direction of the electrification strip 60 corresponding to the contact springs 10.1 and the contact pins 7.11 arranged on the inserts 7 (see Figs. 5A to 5C). A coding option for the inserts 7 results with this arrangement of the contact openings 9.23 and the contact pins 7.11. For fixing the inserts 7 in place, these have snap-in fingers 7.14 with snap-in protrusions seated on their lower insert element 7.1, which engage groove-like counter snap-in elements 6.12 arranged on the inside of the lateral walls 6.1 of the profiled receiving element 6. The snap-in protrusions of the snap-in fingers 7.14 are also provided with steep snap-in flanks in the direction opposite their insertion direction, which act together with correspondingly steep snap-in flanks of the counter snap-in elements 6.12, so that the

inserts 7 are dependably secured. The inserts 7 can be removed, for example by means of a special tool, which acts on lever-like actuating sections 7.13 of the snap-in fingers 7.14, and are arranged in respect to the snap-in fingers opposite a pivot axis of the latter. As can be further seen from Fig. 4A, the hollow space 6.3 of the profiled receiving element is laid out in such a way that its depth is substantially filled by the profiled insulating element 9 and the portion of the insert 7 projecting into the hollow space 9.3. The outward oriented portions of an upper insert element 7.2 rest with their shoulders on shoulders in the upper edge area of the profiled receiving element 6.

As can furthermore be seen in Figs. 5A to 5C, the lower insert element 7.1 has various elements of a current supply socket, such as a grounding spring 7.12, plug-in shoes 7.15, and also an overload release device or bridge elements. The upper insert element 7.2 has plug-in openings 7.21 corresponding to plugs to be inserted.

In the exemplary embodiment in accordance with Fig. 6, two partial profiled insulating elements 9 with embedded contact rails 10 have been inserted into correspondingly matched receiving sections in lateral areas of the lateral wall 6.1 of the profiled receiving element 6. In this case the contact openings 9.23 are embodied as narrow, relatively deep groove-like slits on the top of the contact rails 10, so that an appropriate electric shock protection is also achieved by means of this. Contact of the contact elements of the correspondingly designed inserts is provided at the sides and can be provided, for example, by means of an insertion process and subsequent rotating process, or by laterally shifting the contact elements in the inserts 7.

In the further exemplary embodiment represented in Figs. 7A to 7C, the profiled insulating element 9 is laid out in a U shape, wherein longitudinally extending snap-in grooves 9.22', which constitute the snap-in structure, are formed on the outsides of the U-shaped legs and which in the snapped-in state are engaged on

the inside of the lateral wall 6.1 of the profiled receiving element 6 by correspondingly arranged rib-like counter snap-in structures 6.11. Here, too, steep snap-in flanks are provided in the direction opposite the insertion direction in order to prevent the removal of the inserted profiled insertion element 9. For fixing the inserts 7 in place, groove-shaped snap-in elements 7.14' are arranged on the outsides of the inserts facing the U-shaped legs, and snap-in protrusions are arranged at the corresponding location of the facing insides of the U-shaped legs as counter snap-in structures 6.11', wherein this snap-in connection also has steep snap-in flanks for preventing the easy removal of the inserts 7.

In the longitudinal direction of the electrification strip 60, the inserts 7 are advantageously of a size corresponding to one unit of height. The inserts can also be designed for making contact with contact rails 10 embodied or used as data lines. For electric current supply, they are laid out in accordance with the standards as conventional plug-in units or sockets, for example for plug connections for non-heating devices. In the exemplary embodiment in accordance with Figs. 7A to 7C, the contact pins 7.11 are designed as contact pins with a round cross section, and the contact openings 9.23 are also laid out as round openings.

Several current supply circuits can be established by means of the contact rails 10, for example in that a standard electrical current supply is provided from the top of the frame structure 1, and an interruption-proof electrical current supply, which can be activated in case of need, from the bottom. It is also conceivable to establish three separate current supply circuits by means of the three phases of the a.c. electrical current net, for example with five contact rails 10, one of which is centrally arranged as the center ground rail, to each of which an appropriate number of inserts 7 is assigned, so that too large a load is prevented. In this case the inserts 7 can be appropriately connected at the factory. It is possible to produce an appropriately pre-equipped

electrification strip 60 in accordance with the wishes of the customer. Appropriately equipped electrification strips 60 can also be retrofitted at a later time.

The profiled receiving element 6 (electrification strip) in the exemplary embodiment in accordance with Figs. 8A, 8B and 9 is constructed with an H-shaped cross section, and has the hollow space 6.3 on a front of a center wall 6.4 facing the user, and a further hollow space 6.5 on the back facing away from the user. The inserts 7, which have several, in the present case six, plug-in openings for standardized appliance plugs, can be releasably inserted into the hollow space 6.3, while the connecting lines 16 (see Fig. 10), which can consist of simple connecting cables or connecting wires, or also of contact rails 10, have been placed in the further hollow space 6.5. Receiving grooves 6.6 extending in the longitudinal direction, into which a cover can be slid, have been formed in the free edge areas of the insides of the lateral walls 6.1 bordering the further hollow space 6.5. The cover can first be mounted at a short distance from the frame leg or the wall surface for mounting on the frame support or a cabinet wall or door or mounting plate, and the profiled receiving element 6 with the receiving grooves 6.6 can be pushed or snapped onto it. The counter snap-in elements 6.12 for snapping in the inserts 7 are formed on the free end area on inside of the lateral walls 6.1 bordering the hollow space 6.3 and in the present case also consist of longitudinal grooves.

The inserts 7 with the internally connected contact elements 7.11, which are accessible in a manner protected against electric shock through the plug-in openings 7.21, have cube-shaped module housings, which are closed off at their narrow sides, which are spaced apart from each other in the longitudinal direction, by means of closure pieces 7.3 in the form of front caps at their front. Inserts 7 with plug-in openings 7.21 of different thread, such as for shock-proof plugs, plugs for non-heating devices or different country standards, are provided. Laterally resilient

snap-in fingers, each with snap-in elements 7.14 and manually operable actuating sections 7.13 are formed on the closure pieces 7.3. On their back facing away from the user, the inserts 7 are provided with at least one plug unit, which is matched to electrical shock-proof plug-in couplings 11 inserted into cutouts in the center wall 6.4 and can be brought into contact with them. Two plug-in couplings 11 per insert 7 or modular housing are provided, which are connected to different electrical current supply devices 7.4, 7.5, such as a standard electrical current supply 7.4 and an interruption-proof electrical current supply device 7.5, for example, which can be seen in Fig. 10. The user can simply select the desired electrical current supply for the respective insert 7 in that, following the appropriate rotation of the insert 7 by 180°, he brings the plug-in unit of the insert 7 in contact with the plug-in coupling 11 assigned to the appropriate electrical current supply device 7.4, 7.5.

As shown in Fig. 9, feed-in couplings 12, which are assigned to the electrical current supply devices 7.4, 7.5, are arranged on the front of the center wall 6.4 in the end area of the profiled receiving elements 6, which are also embodied to be protected against electrical shock and can be connected via feed-in plugs 13 with current supply cables 14 to an electrical current supply. As shown in Fig. 10, the feed-in couplings 12, inserted into appropriate cutouts in the center wall 6.4 and connected to the connecting lines 16 at the back, can be integrated into a feed-in module 15, which can furthermore contain a line element for voltage conversion or adaptation, a current limiting device and/or a switching element (contactor) for the sequential activation of individual inserts 7 for protection against an overload. The feed-in couplings 12, or the electrical current supply devices 7.4, 7.5 make available several phases of a three-phase current net, to which the individual inserts 7 are distributed as shown in Fig. 10, in accordance with which the insert module P1 is connected to the phase P1, the insert module

P2 to the phase P2, the next insert (indicated as P3) to the phase P3 and thereafter the following insert again to the phase P1 and immediately, for example.

By means of the described structure of the electrification arrangement, the user is provided with a simple device for retroactively equipping a switchgear cabinet or a rack, for example, with electrical current, wherein he can insert individual inserts as electrical current supply modules at suitable locations without difficulty and dependably.